

REMARKS

Claims 1, 2, 5 and 10 have been amended, and claims 4, 6, 7, 8 and 9 have been cancelled without prejudice. Claims 3, 11, 12, 13, 14, 15, 16, 17 and 18 remain unamended in the application (claims 17 and 18 having been inadvertently numbered as claims 18 and 19 in the application as originally filed).

The Examiner has rejected claims 1 to 18 as presented for examination under 35 USC §103(a) as being unpatentable over ARUN et al. 6,631,386 in view of LARSON 6,571,244.

Claim 1 has been amended to draw a clear patentable distinction over ARUN et al. in view of LARSON.

In particular, claim 1 has been amended by adding the limitation "each state of the database comprising a plurality of data items in a tree structure", as well as the following additional features:

"(e) new record compiling means for compiling a supplementary chunk of data providing a permanent record of the state of the database after the database-modifying transaction and arranged to copy those data items from the permanent record of the state of the database before the database-modifying transaction which have been modified by the transaction whilst not copying those data items from said record which have not been modified by the transaction; and

(f) presentation means for presenting the database in the form of a relational database structure."

These amendments to the wording of claim 1 serve to emphasize the fact that the invention is directed to a unique new relational database management system in which each state of the database comprises a plurality of data items in a tree structure, each node in the tree corresponding to a different data item within a single database version, as can be appreciated from Figures 2, 3, 4 and 5 as filed.

The particular advantage of such a database structure is that it can be built using an append-only medium for all of its permanent data storage. By "append-only" is meant that, once a record has been made, it need never be modified, any subsequent updating of the database resulting in a new record being written. Theoretically, the storage medium for such a database structure could be a CD-R disk which only supports Write-Once data storage. In practice, a magnetic hard disk would be used in "append-only mode".

The advantages of using an append-only storage medium include the following:

1. Increased reliability.
2. Incremental backups easier to perform.
3. Online backups easier to perform.
4. Multi-user concurrency easier to incorporate into database management structure.
5. Database replication easier to incorporate into database management structure.

By contrast, using a conventional (non-append-only) database structure, items 3, 4 and 5 above involve several different computer processes attempting to access a live database simultaneously, which means that care has to be taken that the database does not change unexpectedly as it is being read. If the database is stored on an append-only medium, however, each process can read the database without any difficulty as no other process can modify the database unexpectedly as it is being read.

Such a database management system is neither taught nor suggested by ARUN et al. While Figure 3 of ARUN et al. shows tree data structures, ARUN et al. uses such trees to model the different versions of the database, and there is no suggestion that the system of ARUN et al. uses a tree to model a *single* state of the database with each node in the tree corresponding to a different data item as required by amended claim 1. Instead, in Figures 3 and 5 of ARUN et al., each node in the tree corresponds to a different database version (state).

While the system of amended claim 1 requires each transaction to be recorded by "new record compiling means for compiling a supplementary chunk of data providing a permanent record of the state of the database after the database-modifying transaction and arrange to copy those data items from the permanent record of the state of the database before the database-modifying transaction which have been modified by the transaction whilst not copying those data items from said record

which have not been modified by the transaction", each transaction is recorded by ARUN et al. by appending rows to some of the tables and then modifying the version management fields in *existing* table rows. Thus, the system of ARUN et al. could not use solely an append-only storage medium for storage of records. While ARUN et al. allows the system to query old versions of the database, ARUN et al.'s system is complex and would be slow since it involves a version control subsystem formulating and executing a query for each record returned to the user. By contrast the system of the invention enables querying of an old version of the database simply by following pointers to reconstitute the tree of data items for that version.

The key feature of the relational database management system of the invention that enables the required append-only structure to be provided is the provision of the "root determination means for determining the position of a root data item in each data chunk to which other data items in the tree structure are related" by virtue of the fact that each state of the database comprises "a plurality of data items in a tree structure". This enables a new transaction to be recorded without requiring any modification of the previous state of the database.

As already mentioned above, ARUN et al. does not provide a tree structure of data items. Figure 3 of ARUN et al. simply shows a tree 30 of the different versions (states) of the

database, and does not relate the different data items of the database to one another in a tree structure.

Furthermore, there is nothing in ARUN et al. to suggest use of such "root determination means" or the provision of each state of the database as "a plurality of data items in a tree structure", and indeed ARUN et al. adopts a quite different approach for managing the different versions of the database by adding "version management fields" to each database table (Figure 2 of ARUN et al.).

Furthermore, there is nothing in LARSON to suggest use of such "root determination means" and each state of the database comprising "a plurality of data items in a tree structure". LARSON is concerned with how to use memory means for ordering large amounts of data, using a combination of main memory and data storage. LARSON teaches only how to store discreet, mutually comparable data items in data storage, and does not teach how to store items related within a tree structure as required by the definition of amended claim 1. While LARSON refers to tree structures in main memory, these are only temporary structures used to sort the discreet data items, and do not provide a similar relationship to that required by the wording of amended claim 1.

Because neither ARUN et al. nor LARSON provides any teaching in respect of the ordering of data items in a tree structure or the associated root determination, it follows that

the skilled addressee would not arrive at the claimed invention by a combination of the teachings of ARUN et al. and LARSON.

Each of further claims 2, 3, 5, 10, 11, 12, 13, 14, 15, 16, 17 and 18 remaining in the application is appended directly or indirectly to amended claim 1, and it is accordingly submitted that each of the claims now remaining in the application is novel and inventive over ARUN et al. and LARSON, whether considered singly or in combination.

Furthermore, it will be noted that claim 1 has been amended so as to direct it to a "relational" database management system for presenting the database in the form of a "relational database structure", and it is believed that the advantages of providing a relational database (within which data items are organized as a set of formally-described tables from which data can be accessed or reassembled in different ways without having to reorganize the database tables) in which each state is defined by data items in a tree structure is unique and provides a number of previously unpredicted advantages in terms of version control and storage within the relational database management system.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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A handwritten signature in black ink, appearing to read 'Robert J. Patch', written over a horizontal line.

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